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A new alignment control scheme to mitigate birefringence effects for KAGRA and next-generation gravitational wave detectors.

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KAGRA is often referred as a 2.5-generation gravitational wave detector as it operates underground with test-masses at cryogenic temperature; features that will be implemented in future gravitational waves detectors. One of the constraints of operating at cryogenic temperature is that it requires the use crystalline test-masses. KAGRA test-masses substrates are therefore 22kg sapphire crystal. However, the birefringence of sapphire substrates was found to affect both the the sensitivity and duty-cycle of KAGRA during the joint observation run with GEO600; mainly due to the birefringence coupling to the KAGRA alignment control.

We propose to use a new alignment control scheme that should allow to properly reconstruct both the alignment signal and the birefringence coupling. We are now working on the table-top demonstration before its implementation in the KAGRA detector.

Auteur principal: EISENMANN, Marc (National Astronomical Observatory of Japan)

Orateur: EISENMANN, Marc (National Astronomical Observatory of Japan)

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